

# LSHT Motor Is Foundation of Drive

## AMERICAN PILEDRIVING EQUIPMENT

(APE), Kent, Wash., forms the foundation of large construction projects. Literally. Among the many heavy-duty machines the company designs and manufactures are top-drive augers, which drill holes into the ground for foundations. Once the auger has drilled to the required depth, grout, concrete, or other material is pumped into the bottom of the hole through the hollow center of the auger as it is withdrawn from the hole. The contractor then inserts preformed, caged rebar assemblies into the just-cast material to form a reinforced column.

Hydraulics was chosen for this application because of its high power density. A low-speed, high-torque motor transmits the high torque and provides the speed control needed for the varying conditions typically encountered when drilling into the ground. The systems can be used on mobile excavators, so the mobility and flexibility of hydraulics made it the most practical choice.

A big advantage to APE's top-drive auger is that it can shift on the fly. Contractors can drill, retract the auger, and spin off dirt and mud without stopping the operation. Other machines use gearboxes to accomplish drive functions, which requires stopping the auger to shift from one drive mode to another.

## SIMPLE, POWERFUL HYDRAULICS

The machine can drill at two speeds: 0 to 30 rpm at 5,500 psi or speeds to 60 rpm at 3,000 psi. Operating speed is determined by soil and ground conditions; speed can be changed automatically to give the machine the highest rate of productivity possible. All functions can be done on the fly without stopping the drilling operation.

Design of the top-drive auger's hydraulic system was a team effort, led by Dan Miller, chief engineer at APE, working in conjunction with Kris LaVigne, of Hydra Power Systems, Portland, Ore. Hydrapower supplied all the hydraulic compo-



**This top-drive auger uses a powerful Black Bruin radial-piston motor to control speed and torque. The motor has a hollow shaft, so grout, concrete, or other material can be pumped right into the center of the hollow auger.**

nents, including a wide variety of cartridge valves from Sun Hydraulics, Sarasota, Fla.

However, the star of the system is a Black Bruin S Series hydraulic motor. Black Bruin motors are a product of Sampo Hydraulics Ltd. in Finland, and supplied to North America through North American Hydraulics LLC, Baton Rouge, La.

Kent Strand, CFPS, of North American Hydraulics, explained that the Black Bruin offers high efficiency because its cam-roller radial-piston design converts hydraulic energy directly to final speed and torque without the need for gearing. The hollow-shaft configuration of the motor made it the clear choice because concrete or grout can be pumped through the motor's output shaft.

The S Series is Sampo's most-powerful Black Bruin hydraulic motor, rated to 500 kW. Like other Black Bruins, it uses a cam-lobe radial-piston design for low-speed, high-torque power. Unlike the others, output is transmitted through a solid or hollow shaft, as opposed to a rotating housing. Tapered-roller bearings allow the motor to support radial and axial loading, and its multiple-speed function can be shifted on the fly. It comes in eight displacements from 4,000 to 18,900 cm<sup>3</sup> with maximum working speeds to 180 rpm, and maximum torque output to 83,045 N-m.

Strand explained, “One of the challenges we faced was accommodating the hydraulic lines and the case drain line for the travel length and height of the application. The drilling sled would sometimes go up to heights in excess of 100 ft. Manifolds and the Sun cartridge valves supplied by Hydra Power Systems helped us conquer this challenge and help make the machine fully automatic in its function.”

FOR MORE on Black Bruin motors and other products from North American Hydraulics, visit [www.nahi.com](http://www.nahi.com). See a video of the cam-roller radial piston design at [bit.ly/HP147BBS](http://bit.ly/HP147BBS).

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### EXISTING CHALLENGES

The common maintenance interval between overhauls for this equipment is five years. This maintenance involves disassembling, inspecting, and repairing the piston accumulators for recertification. This process is extremely time consuming and labor intensive because continuous exposure to salt-water deep in the ocean causes heavy corrosion that complicates disassembly. Rig personnel may attempt to disassemble the accumulators offshore, but



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